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REDISCOVERY OF *ACTINOTE ZIKANI* (D'ALMEIDA) (NYMPHALIDAE, HELICONIINAE, ACRAEINI): NATURAL HISTORY, POPULATION BIOLOGY AND CONSERVATION OF AN ENDANGERED BUTTERFLY IN SE BRAZIL

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ABSTRACT. *Actinote zikani* (D'Almeida) (Nymphalidae, Heliconiinae, Acraeini) was rediscovered in 1991 in Paranapiacaba, São Paulo, 40 years after its original description (based on specimens from the Boracéia Ecological Station, Salesópolis, São Paulo); 49 years after its last collection, and studied during three years. The adults go through two yearly generations, one in March (earlier than the other species of *Actinote* in the region) and the other in November (bivoltinism). The mean residence of the adults is less than one week, and the sex ratio in the field is male biased. The only known host plant for the species is *Mikania obsoleta* (Asteraceae), and the immature stages are similar to those known for other species of *Actinote*. The range of *A. zikani* is within one of the most densely human populated regions in Brazil, making urgent the creation of effective preserved areas where colonies of this species are known.

Additional key words: Atlantic forest, Bivoltinism, *Mikania*, Neotropical

In 1941 and 1942, Romualdo Ferreira D'Almeida collected 10 individuals of a dark *Actinote* Hübner at the Estação Biológica de Boracéia in Salesópolis, São Paulo, which were misidentified as *Actinote morio* (D'Almeida, 1943). Later, notified by J. F. Zikán (a field naturalist who lived near Itatiaia, RJ) D'Almeida corrected himself, recognizing the status of this species and describing it as *Actinote zikani* (D'Almeida, 1951). This species was described based on material collected by D'Almeida from Boracéia (Salesópolis) and one male collected by Roberto Spitz from Alto da Serra de Santos, SP in 1941. A survey revealed that the 11 specimens cited by D'Almeida are now in the Museu de Zoologia da Universidade de São Paulo (MZUSP; Lamas 1973) and the Museu de Zoologia da Universidade Federal do Paraná (Mielke & Casagrande 1986). Additionally, KB saw another 18 specimens collected by R. Spitz from the Alto da Serra de Santos, in the collection of the Natural History Museum (London). From 1985 to 1990, *A. zikani* was searched for intensively by RBF and AVLF in the type-locality in April-May and November-December, and also in other sites with the same environmental characteristics (Francini 1992), but none were seen. The only new information was from KB who saw a possible male of this species on the wing in April 1981 on the edge of the road from Tapiraí to Sorocaba, in southern São Paulo state, about 1000 m altitude in a very wet forest. Because of the difficulty in finding extant colonies of this species, KB proposed the inclusion of *A. zikani* on the list of Brazilian species possibly threatened with extinction (Bernardes et al. 1990; Brown 1991), and since then, *A. zikani* has been classified as critically endangered (SP-SMA 1998, MMA 2003). With intensive searching, finally on 16 March 1991 (1100 h), on a routine trip, RBF and AVLF found a male flying at the summit of the Serra do Mar, 20 km northeast of the city of Santos, São Paulo. With data from this locality, the present paper describes the natural history and population biology of *A. zikani*, information important to the conservation of the species and its habitat.

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STUDY SITE AND METHODS

The population studied was located in the Santo André municipality, São Paulo State, near the village of Paranapiacaba. Most field work was carried out in a place east of Paranapiacaba, along a road 2500m long (SW-NE following the orientation of the mountain chain), paved with concrete blocks, connecting two groups of towers (television and microwaves) on peaks of Serra do Mar reaching 1200 m (Fig. 1). Because of the high rainfall, the road on the summit was built with a good drainage network; there are also four small creeks running across the road. Sometimes the road and drains were cleared, but the trees next to them were

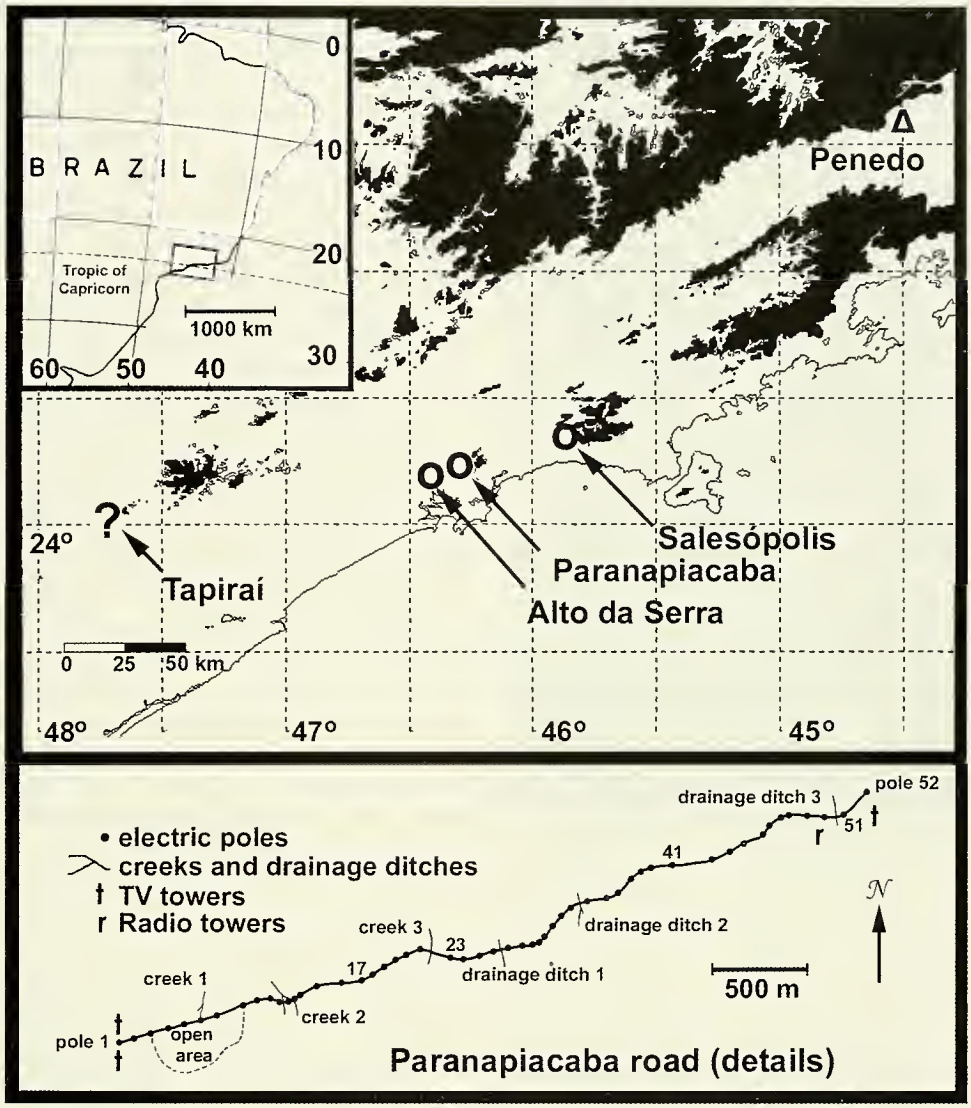

FIG. 1. Study area in Southeastern Brazil (modified from IGGSP 1972a). In the regional map, open circles show the known present and past collecting sites of *A. zikani*; the question mark indicates a doubtful record and the triangle is a locality with a possible undescribed subspecies of *A. zikani*. Black areas indicate altitude above 1000m.

always maintained. The road was mapped with the aid of a tape measure and a compass using a 1:50,000 topographic chart (IGGSP 1972). All 52 electric poles along the road were numbered, permitting the location of each butterfly to be recorded to the nearest 50 m.

The study area is in the rainiest part of Brazil outside of the upper Amazon. The mean annual rainfall between 1870 and 1939 was over 3500 mm, with a minimum of 2355 mm in 1874 and a maximum of 5563 mm in 1872 (NOAA 1998). Data from SIGRH (2003) show that the mean annual rainfall between 1936 and 1996 was 3164 mm, with an extraordinary minimum of 826 mm in 1990 and a maximum of 4739 mm in 1947. The rains roughly occur 15% in winter (June-September), 25% in spring, 35% in summer and 25% in autumn (Santos 1965). Fog is frequent in the study site, and a sunny day could suddenly change to misty and rainy.

The original vegetation is montane rain forest (Ururahy et al. 1984). On the edge of the road above 1000m, there are many patches of bamboos, and "manacá-da-serra", "quaresmeira" (*Tibouchina* spp.; Melastomataceae), and the vine *Mikania hirsutissima* (Asteraceae) are abundant. The trunks and stems of most plants are covered by various epiphytic mosses and ferns. In this area 16 species of Asteraceae were found

which could be potentially used as foodplants by larvae of *Actinote* spp. (RBF unpublished results).

After the discovery of the population of *A. zikani* near Paranapiacaba in 1991, 48 trips were made to the study area up through June 2004 (161 hours of field work); 24 days from January to December 1991 (1-180 days interval), 14 days from July to November 1993 (1-40 days interval) and 10 days in March-June 1994 (1-20 days interval). Butterflies were observed with binoculars and various aspects of behavior were photographed; some individuals were collected for morphological study. All material including the reared specimens was deposited in the collection of the MZUSP.

This population was studied by a mark-release-recapture method (MRR). Each captured individual received a small numbered circle of impermeable paper glued to the ventral base of the left hindwing. This marking technique permits rapid marking and data retrieval; it was previously tested by RBF and used in a population study of *Actinote pellenea pellenea* Hübner in 1988, *Actinote mamita mitama* (Schaus) in 1990, and *Stalachtis phlegia susanna* (Fabricius) (Riodinidae) in 1992 (RBF, unpublished data). For each marked butterfly, sex, "age" (based on wing wear), forewing length, location and the time of day were recorded (as in Freitas 1993, 1996). The relative daily abundance was obtained dividing the total number of males sighted by minutes of observation effort, later transformed to butterflies per hour (based only on days with weather conditions favorable for the flight of the butterflies). The MRR data for the summer 1993 generation (12 field days, 1-7 days interval) was analyzed by the Lincoln-Petersen-Bailey method (Southwood 1971) for estimating population parameters (software developed by RBF, UNISANTOS). In most cases, only males were analyzed because of the low number of females recorded. Daily results were tabulated as "number of individuals captured per day" (NICD), and "number of individuals present per day" (NIPD), following Ramos & Freitas (1999). To estimate the NIPD, recaptured individuals were considered to be present in the population on all previous days since the day of first capture. Numbers of reared lots are sequential in the RBF data bank.

RESULTS

Geographic distribution. All known present and past colonies of *A. zikani* are found in a limited area between Salesópolis and Paranapiacaba (São Paulo): Alto da Serra de Santos (a partly unknown spot that could include part of Paranapiacaba), Paranapiacaba and the Estação Biológica de Boracéia (Salesópolis) (Fig. 1). There is also a mention of this species occurring in southern Minas Gerais (D'Almeida 1951). In November 1991, a male *Actinote* with whitish color pattern was collected by the authors in Penedo, Rezende (Rio de Janeiro), in the foothills of the Serra do Itatiaia. Although the genital armature of this individual is similar to that of *A. zikani*, more material will be necessary to confirm the status of the specimen from Penedo.

Flight activity. The flight activity of *A. zikani* is variable and dependent on weather conditions. Butterflies usually start to fly at approximately 0800 h, when direct sunlight reaches the forest (the summits to the southeast are higher and shade the study area before this time); they open and shut their wings in direct sunlight, basking in a cyclic process until the beginning of flight. On warm but moist days, the flight activity diminished shortly after the sun was covered by clouds. On 20 March 1991, the peak of activity was around 0830 - 0900 h, which was the warmest period of the day (Fig. 2). Males usually fly more than 2 m above the ground along the road, and in forested areas they usually fly above the canopy. Males attack any flying insect that gets less than 1 m from them, when they quickly go up to almost 10 m above the ground or rapidly cover a linear transect of more than 100 m. The relatively small males of *A. zikani* were seen to persecute butterflies as large as *Morpho hercules* (Dalman) (Nymphalidae: Morphinae).

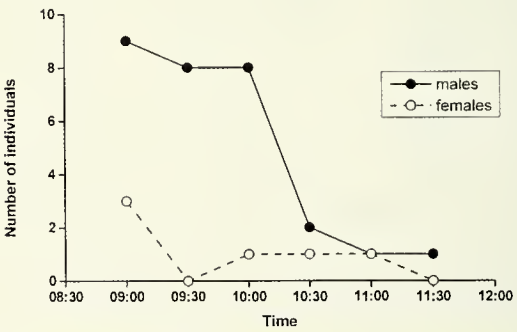

FIG. 2. Flight activity of *A. zikani* in Paranapiacaba, SP, in March 20, 1991, in the area between poles 50 and 51.

Mating. Mating in *A. zikani* occurs without any apparent courtship display. The patrolling male follows a female; after flying 2 to 5 m in a straight line about 2 m above ground they make a spiraled flight to the ground, at the end of which the male grasps her abdomen with his valves, forcing copulation on the ground (n = 5). There is always formation of a plug (sphragis) in the female (as in other *Actinote* species), but in *A. zikani* it is mostly internal and inconspicuous, similar to that

known in *A. discrepans* D'Almeida. Attempts to copulate are sometimes unsuccessful, but once it occurs, it can last more than 30 minutes. On 17 November 1993 a mating pair observed at 0830 h continued "in copula" until at least 0908 h when RBF left the area.

Foraging activity. Feeding activity of adults occurs in the coolest hours of the day, soon after sunrise or before sunset. In the March-April generation of 1991 and 1994, the males were observed drinking nectar from the inflorescences of *Mikania triphylla* (Fig. 3), *Mikania micrantha*, *Eupatorium gaudichaudianum* (Asteraceae), *Mitracarpus hirtus* and *Borreria verticillata* (Rubiaceae). All these food resources were very scarce during the study period, especially in 1994. In the November generation the main nectar sources were two species of myrtaceous trees (*Myrcinia*) that were common along the road. The presence of butterflies was directly related to food resources, with more butterflies present in places with more flowers. On some occasions (cloudy days) females were observed on the ground, or on petals of "manacá-da-serra" (*Tibouchina* sp., Melastomataceae) or large flowers of the exotic "lírio-do-brejo" (*Hedychium coronarium*, Zingiberaceae). In these situations, they appeared to be drinking the accumulated water.

Larval foodplant. The larval foodplant of *A. zikani* is *Mikania obsoleta* (Vell.) G. M. Barroso, discovered after observation of two ovipositing females on 1 April 1991. This is the only hostplant of *A. zikani* known in the study site (from a total of 13 species of *Mikania* present there). *M. obsoleta* was not observed being used by any additional species of *Actinote*. This plant is a climber with halberd-shaped smooth leaves (Fig. 3). It grows around tree trunks climbing to 6 m height. Most individuals of *M. obsoleta* grow near small creeks, in places with wet soil in open canopy areas. The growth of *M. obsoleta* (measured by the number of new leaves) was relatively slow compared with that of other *Mikania* species in the area (e.g. *M. hirsutissima*) (RBF unpublished results). Flowering occurs from October to November and the flowers were not observed attracting any butterflies. A program of monitoring the hostplants revealed that many individuals of *M. obsoleta* tagged in November 1993 had disappeared by April 1994. More than 20 plants disappeared after cleaning of the rivulets (area between poles 16-17) and near creek 1, but some plants inside the forest on the borders of creek 3 also disappeared without any sign of human action.

Oviposition behavior. Females of *A. zikani* had an oviposition behavior similar to that observed in other *Actinote* species (Francini 1989). The female flies

Fig. 3. Above - a male *Actinote zikani* drinking nectar from flowers of *Mikania triphylla*. Below - Close-up view of plant of *Mikania obsoleta* showing details of the halberd shaped leaf and the inflorescence.

around the foodplant landing briefly on some leaves, and after choosing a leaf it lands on its ventral surface. After a period of inactivity (1-5 min) the female starts ovipositing, continuing for up to one hour. On 1 April 1991, five ovipositions were observed in the study area, including one leaf with a double oviposition (two different females observed ovipositing together, lots F-2337 and F-2338). Oviposition in the laboratory was also obtained with a female in a glass jar with a piece of foodplant under a 150W incandescent light bulb (following Francini 1989 and Freitas 1991) (oviposition lot F-2361). In this case, the entire process lasted five hours with the female constantly vibrating her wings. In 1993 only one oviposition was found on a plant inside the forest near a creek, and in 1994 no oviposition was observed in the study area.

Immature development and behavior. Detailed descriptions of the life cycle of *A. zikani* will be presented in a further paper (RBF in prep.). Eggs of a double oviposition collected in the field on 1 April 1991 (F-2337 and F-2338) hatched on 15 April 1991 in laboratory conditions. First instar larvae of *A. zikani* left

the egg after eating the lateral walls of the chorion, leaving the remainder of the egg intact. Feeding activity started after 3-5 hours, and small larvae ate only the ventral epidermis. The fecal pellets were glued onto the leaf by silk, not falling to the ground. There was no significant difference between the mean duration of the larval periods for males (72.5 days, SD = 2.76, n = 16) and females (73.6 days, SD = 2.68, n = 12) (t = -1.0414, P = 0.30, DF= 26), nor between the mean duration of the pupal periods for males (mean = 17.2 days, SD = 1.41; n=16) and females (mean = 16.9 days, SD = 0.94, n = 12) (t = 0.4473; P = 0.66, DF= 26). In laboratory conditions, the larvae hatched on 15 April 1991 reached the last instar at the beginning of June; pupation occurred at the end of June and adults emerged in August (almost two months earlier than the flight period in the field). The mean total duration of the life-cycle in the laboratory (egg to adults) was 105.7 days (SD = 3.92, n = 28) or roughly three and half months. Trips to the field during all these months showed absence of adults before November. The same life-cycle pattern was observed in 1993 and 1994.

Chemical protection and predation. Qualitative tests for cyanogenesis (following Francini 1989) were done with one male, five eggs, two first instar, and one last instar, and all were positive as for other known species of Neotropical Acraeinae (Brown & Francini 1990). In the field, one oviposition (F-2342) was observed being partially eaten by ants of the genus *Pheidole*. Additionally, a dead male was observed in a web of *Nephila clavipes* (Arachnida: Araneida). No predation on larvae and pupae were observed in the field.

Population biology. Four generations of *A. zikani* were followed between March 1991 and April 1994. Adults of *A. zikani* are bivoltine, with flight periods of about one month; the first generation occurs in March/April (autumn generation) and the second in November (summer generation). In 1991, the autumn generation flew from 16 March to 17 April, and the summer generation from 7 November to 24 November. In 1993 the summer generation flew from 1 November to 28 November, and in 1994 the autumn generation flew from 19 March to 4 April.

The number of butterflies sighted per hour (BSH) varied between 3 and 8 (mean = 5.05, SD = 2.39) in the March-April generation of 1991, between 1 and 17 (mean = 5.33, SD = 4.81) in the November generation of 1993 (Fig. 4) and between 13 and 20 (mean = 14.85, SD = 2.98) in the March-April generation of 1994.

Of the 190 males captured and marked in November, 1993 only 10 (5.3%) were recaptured. Eight individuals were recaptured once, and two individuals were recaptured twice. In March-April, 1994, due to the unfavorable weather conditions, 35 males were marked and only two recaptured (5.7%). In November 1993, males started to fly on 1 November and females only on 6 November. Both sexes reached highest numbers from 12 - 18 November, after which the population diminished to low numbers until disappearing before the beginning of December (Fig. 4). The number of individuals present per day (NIPD) in the summer 1993 generation varied from 1 to 48 (mean = 18.3, SD = 15.5, n = 11 days) (Fig. 4). The estimated population size based on Lincoln-Petersen-Bailey in November 1993 showed that population peaks can include more than 1000 males in the study site (Table 1).

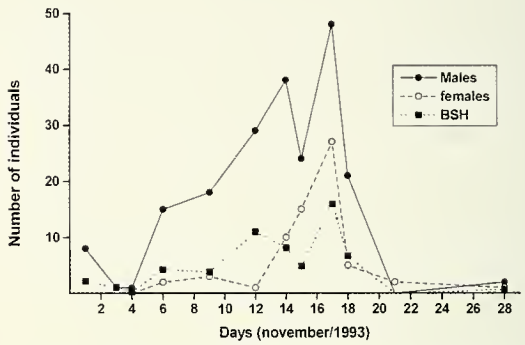

FIG. 4 - Number of individuals present per day (NIPD) for males (solid circles) females (open circles) and number of butterflies sighted per hour for males (BSH solid squares) in November 1993 in Paranapiacaba, SP.

Sex ratio. The sex ratio in the field was male biased in all study periods (Table 2), with lowest male:female ratios in November 1993. In the laboratory, the sex ratio was not different from 1:1 (Table 2). In the November 1993 generation, males were the dominant sex in all but one day with more than 15 individuals (Table 1).

Age structure and residence time in 1993. Most of the first captures of both sexes were individuals of "intermediate" age (59% of males and 63% of females). The age structure in November 1993 shows a clear pattern of individuals becoming older from the beginning to the end of flight period (Fig. 5). Residence time for males ranged from two to six days, with six males lasting two days, three males lasting three days and a single male lasting six days (mean = 2.7 days, SD = 1.25; n = 10). A single female was recaptured during the study, with a residence of 10 days.

Vagility. The average distance traveled by males in 1993 was 232.3 meters (SD = 287.9; n = 17), not significantly different of that of females (mean = 136.7

TABLE 1 - Summary of population data for the summer 1993 generation of *Actinote zikani* in Paranapiacaba, SE Brazil. NICD = number of individuals captured per day, M = males, F = females; NIPD = number of individuals present per day (males only), BSH = butterflies sighted per hour (males only) rounded off to nearest integer, LPB - number of butterflies estimated by Lincoln-Petersen-Bailey, SE - standard error. An asterisk indicates a male biased sex ratio (chi square test [χ^2], $p < 0.05$).

Date	NICD		Sex ratio	NIPD	BSH	LPB	SE
	M	F					
1993							
01/NOV	8	0	—	8	2	8	—
03/NOV	1	0	—	1	1	1	—
04/NOV	1	0	—	1	1	16	21
06/NOV	14	2	7:1*	15	4	142	142
09/NOV	18	3	6:1*	18	4	270	295
12/NOV	29	1	29:1*	29	11	157	98
14/NOV	31	10	3:1*	38	8	444	481
15/NOV	22	15	1.5:1	24	5	1104	1514
17/NOV	45	27	1.7:1*	48	16	1034	366
18/NOV	20	5	4:1*	21	7	63	8
21/NOV	0	1	—	0	0	—	—
28/NOV	2	1	—	1	1	—	—

TABLE 2 - Sex ratio of marked and reared *Actinote zikani* from Paranapiacaba, SE Brazil. An asterisk indicates a male biased sex ratio (chi square test [χ^2], $p < 0.001$).

	Males	Females	Sex ratio	χ^2
Field captures				
Autumn 1991	50	11	4.5:1	24.9*
Summer 1993	190	65	2.9:1	61.3*
Autumn 1994	35	2	17.5:1	23.5
Reared material				
Lot 2337	3	3	1:1	—
Lot 2338	13	9	1.4:1	0.727

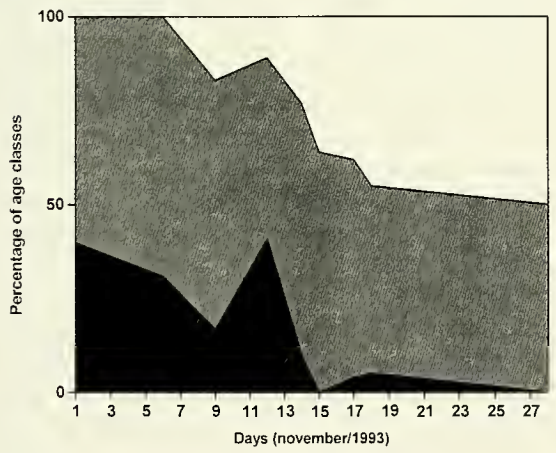

FIG. 5. Age structure of *Actinote zikani* in Paranapiacaba, Santo André, SP, in November 1993. Black = fresh individuals, gray = intermediate individuals, white = old individuals as % of each day's captures.

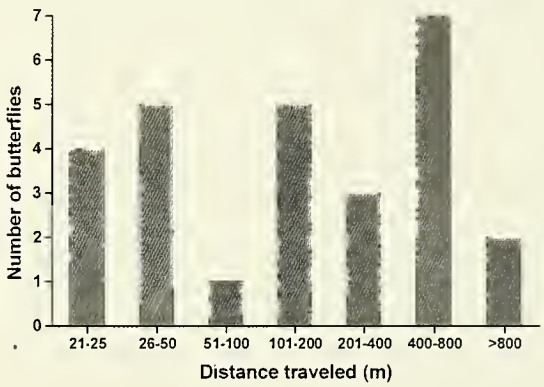

FIG. 6. Maximum distances traveled by *Actinote zikani*, using MRR data from generations of November, 1993 and March, 1994 in Paranapiacaba, SP.

meters; SD = 195.0; n = 3) (t = -0.5474, P = 0.59, DF = 18). Individual butterflies were recaptured up to 1000 m from their marking point. On 6 April 1991 a female of *A. zikani* was collected flying in a straight line in a westward direction along the road to Paranapiacaba, about 4 km from the study area. Fig. 6 shows the vagility of *A. zikani* based on data from summer 1993 and autumn 1994.

Adult size. Based on sampled individuals from March-April 1991, the forewing length of females (mean = 37.14 mm, SD = 2.575, n = 64) was greater than that of males (mean = 32.88 mm, SD = 2.539, n = 197) (t = 12.281, p < 0.05, DF = 259). In the same period, the dry weight of males varied from 0.30 to 0.48g (mean = 0.41g, SD = 0,052, n = 10), and the dry

weight of the females varied from 0.65 to 0.89g (mean = 0.74g, SD = 0.098, n = 5), showing that even though females weighed almost twice as much than males, the length of their forewing was only 1.1 times greater. Adults of *A. zikani* are large, compared with other species in the genus *Actinote* (RBF unpublished data).

DISCUSSION

Natural History and Population Biology. In most aspects of population biology and natural history, *A. zikani* is similar to the other known species of *Actinote* from SE Brazil. The bivoltinism is characteristic of most known species of *Actinote*, except *A. pellenea* and *A. brylla* Oberthür, that can be multivoltine in warm places, and most red species in the "red mimicry complex" that are univoltine (Francini 1989, 1992, Penz & Francini 1996). The adult permanence in the population of less than one week is low if compared with most neotropical butterflies (Ramos & Freitas 1999), but it is similar to the values obtained for most species of *Actinote* (Francini 1989 and unpublished data). These low values are suggested as a combination of short lifespan and high dispersal rates in these butterflies (Francini 1989). Even if flight periods and time intervals (about one month) are similar to the duration of generations of other *Actinote* species (Francini 1989), there is an asynchrony of *A. zikani* with relation to other *Actinote* species of about one month. During the present study, other species of *Actinote* like *A. canutia* (Hopffer), *A. carycina* Jordan, *A. parapheles* Jordan, *A. melanisans* Oberthür and *A. genitrix* D'Almeida began to fly in Paranapiacaba only in the middle of April in the autumn generation (*A. zikani* started in early March). It is interesting to note that the labels of Museum specimens (April 1941 and December 1931) contributed to the delay in finding the species, since much time was spent in the field 20-30 days after the flight period of *A. zikani*. The male biased sex ratios recorded for *A. zikani* in the field are similar to those of the other 13 species of *Actinote* from SE Brazil (Francini 1989). Male biased sex ratios are usually observed in butterflies in the field even if laboratory broods are 1:1 (Brussard & Ehrlich 1970, Freitas 1993, 1996, Ramos & Freitas 1999). The recapture rate of about 5% recorded for *A. zikani* is low even if compared with those of other species of *Actinote* (Francini 1989). Francini (1989) recorded recapture rates of 12% and 8% for *A. pellenea pellenea* and *A. brylla* Oberthür, 1917 respectively in the coastal plain of São Paulo.

General features of the immatures conform to those of other species of *Actinote* (Francini 1989, 1992). The host plant agrees with the suggestion of D'Almeida (1951) who proposed that the host plant of *A. zikani* should be a species of *Mikania*. Immatures of *A. zikani* are gregarious like all other known Neotropical Acraeinae (Francini 1989), and the presence of a double oviposition (two different ovipositions in the same leaf) is also observed in other species that apparently have gregarious ovipositing (Francini & Freitas unpublished data). The pattern of lateral eclosion differs from all other known *Actinote*, whose larvae exit through the micropylar region (Francini 1989). Maybe the most remarkable feature is the fast development of immatures in laboratory conditions; only three and half months without periods of diapause or slow growing. Even though the larvae were reared under temperature conditions (25°C ± 2°C) different from those in the field (that can be near 0°C on some winter nights), the duration of the larval stage in *A. zikani* was exceptionally short for an *Actinote* species, except for some broods of *Actinote pellenea pellenea* that were reared in summer at sea level (about two months, Francini 1989 and unpublished data). This capacity to grow quickly at high temperatures could be an indication that any *Actinote* could be multivoltine if conditions are adequate.

Conservation of *A. zikani* and its habitats. The conservation status of *A. zikani* was defined as critically endangered in the most recent evaluation of the Brazilian list of endangered species (MMA 2003), based on a combination of: restricted area of occupancy, few known and declining populations and sites, small total population size and extreme fluctuations in number of mature individuals (categories B2 bii, iii, iv c Cb - criteria from IUCN 2001). Only one colony is known at present (this paper); based on museum specimens there are at least two other possible sites where *A. zikani* has occurred (see Fig. 1). Undoubtedly, there is an urgent need for discovering more colonies of this species in the region. The analysis of topographic charts (1:50,000) between Paranapiacaba and Boracéia revealed 10 areas with altitude from 1100 to 1200 m, within 10 km from the Serra do Mar break, all potentially suitable for a population of *A. zikani*. Visits to some of these areas should be an immediate priority. Further areas SW of Paranapiacaba should also be visited; although winter temperatures are lower towards the south (Nascimento & Pereira 1988; Nimer 1972, 1989) little is known about the tolerances of this species and the potential occurrence on both NW- and SE-facing summits. In any case, if there is still a population present in the Estação Biológica de Boracéia, or in any additional location northward, it will be partially isolated from the population studied in Paranapiacaba, since much of the original forest throughout this region has been replaced by eucalyptus trees.

Even the colony of Paranapiacaba is not completely protected. The area is constantly visited for maintenance of the towers, resulting in clearing of the roads and of the drainage network, leading to vigorous growth of more aggressive *Mikania* species that overcome *M. obsoleta*. The heavy ecotourism in the region contributes to environmental degradation and accumulation of garbage in the initial part of the area. The entire ridge of the Serra do Mar area including the region of Paranapiacaba is discontinuous to the southwest, where two major superhighways, two railroads, many oil ducts and service roads, several cleared tracks for power line maintenance, and increasing urbanization of the slopes of the mountains (below 400 m) create a mosaic of unsuitable habitats.

Perhaps due to the extensive and continuous modification of the vegetation in the entire region, recent trips to the area (1997 to 2005) showed no trace of *A. zikani* and few plants of *M. obsoleta*. This microsystem appears to be composed of fugitive species (cf. Horn & MacArthur 1972) which compete poorly with relatives better adapted to this patchy environment (see the example of *Heliconius nattereri* Felder & Felder in Santa Teresa, Espírito Santo in Brown 1972). Nowadays the area seems apparently less impacted (with a single new tower constructed there), but the food plants (*M. obsoleta*) continue to disappear.

The history of environmental conservation in the area of the Serra do Mar in the State of São Paulo starts at the beginning of twentieth century, when Herman von Ihering, director of the Museu Paulista (now Museu de Zoologia da Universidade de São Paulo) demonstrated the need to create federal legislation to regulate bird hunting (Ihering 1902), and later emphasized the conservation of forests (Ihering 1911). At the end of 1909 he set up on his own property a sanctuary, the "Estação Biológica do Alto da Serra", now under responsibility of the Instituto de Botânica da Secretaria da Agricultura do Estado de São Paulo (Kirizawa et al. 2004). This protected area is located SW of Paranapiacaba, and unfortunately has been heavily polluted with fluoride and other chemical contaminants from the Cubatão industrial area at the base of these mountains (Klump et al. 1996; Kirizawa et al. 2004).

Future perspectives. The observations made here are an initial step to a better understanding of this fugitive pair of species *A. zikani* and *M. obsoleta*. To help answer the open questions, the following actions are needed: more accurate estimates of population parameters (mean residency time and home-range), verification of the impact of the ants that prey on eggs, better estimates of population parameters of the foodplant, and laboratory testing of larval acceptance of other *Mikania* species. In spite of the study site being close to a contaminated area (see above), the population of *A. zikani* is relatively protected against air pollution by the summits of a nearby mountain range, that deflect the winds toward the west.

The reasons for the observed disappearance of the population in the study area (see above) were not investigated. Perhaps there is a natural cycle of this pair of species, becoming common in a few years and scarce in most (as observed for some species of *Actinote* by the authors).

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